grab sampler 130 may be triggered by the air monitoring unit 102 itself, based on monitoring by the air parameter sensor 220. Alternatively, the air parameter sensor 220 may be monitored by the website 166 through the Internet. A command transmitted from the website 166 through the Internet 178 to the air monitoring unit 102 may trigger the capture of an air sample so that a more detailed analysis of the air quality parameter can be performed. In either case, the taking of the grab sample is triggered when the parameter sensed by sensor 220 meets a predetermined criteria. It will be understood that the criteria for triggering the taking of the grab sample can be based on measurements by two or more sensors and/or on other information.

B13 cont'd

REMARKS

Applicants respectfully request entry of this preliminary amendment prior to examination of this application. By this preliminary amendment, Applicants have made minor changes to the specification to conform the specification to the newly submitted formal drawings. Specifically, Figures 1, 7 and 8 have been relabeled in the specification on pages 9-11, 15-17, 21, 24 and 28 as Fig. 1A and 1B, Fig. 7A and 7B, and Fig. 8A and 8B, respectively, to conform with the formal drawings. Each of these figures has now been separated onto two drawing sheets, so that the drawings are more clearly understood as they are not crowded onto one sheet. Reference numeral 162 has been added on page 9 to clarify that a central computer and controller is also shown in Fig. 1A and 1B, Fig. 7A and 7B and Fig. 8A and 8B. Additionally, communications control and media interface 168 was added to the text on page 17, and communications media 180 and communications control and media interface 168 were added to the text on page 18. Support for these changes may be found at least in Fig. 1A and 1B and Fig. 8A and 8B. No new matter has been added.

The claims as presented are believed to be in allowable condition. Favorable action is earnestly solicited. If there is a fee occasioned by this preliminary amendment, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

Respectfully submitted,

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Dated: May 22, 2002
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MARKED-UP SPECIFICATION

Please replace the following paragraphs as shown.

On page 9, replace lines 2-3 with the following paragraph:

FIG. 1A and 1B is a schematic block diagram of an air monitoring system according to an embodiment of the invention;

On page 9, replace lines 14-15 with the following paragraph:

FIG. 7A and 7B is a schematic block diagram of an air monitoring system according to another embodiment of the invention; and

On page 9, replace lines 16-17 with the following paragraph:

FIG. 8A and 8B is a schematic block diagram of an air monitoring system including a grab sampler according to one embodiment of the invention.

On page 9, replace lines 20-29 with the following paragraph:

Referring to FIG. 1A and 1B, a schematic block diagram of one embodiment of an air monitoring system 100 according to the present invention is shown. The air monitoring system may be a portable or an installed system, or a system having a combination of portable and installed components. The air monitoring system 100 includes an air monitoring unit 102. In a portable system, the air monitoring unit 102 may be hand held or reasonably portable. The air monitoring unit includes a sensor unit 103 having at least one sensor 104 and a control unit 106. In a portable system the air to be sampled, or sample locations 108, may be taken from the area immediately surrounding the air monitoring unit or through a tube (not shown) from one or more remote sample locations.

Replace page 9, line 30-page 10, line 30 with the following paragraphs:

An installed system may have many different configurations. The installed system may include an air monitoring unit 102 installed in a building to monitor one or more spaces within the building. Referring to Fig. 2, the installed system may use one or more sensor units 110 to monitor sample locations 108, where each sensor unit 110 has one or more sensors 104 for

monitoring desired air quality parameters. Each sensor unit 110 may, for example, have the configuration of sensor unit 103 shown in Fig. 1A and 1B. The sensor units may be distributed in desired locations inside and outside the building. The sensor units 110 connect through a network connection 112 to a central computer and controller 118 or 162. For example, as shown in Fig. 2, the sensor units connect to a sensor network interface control unit 116, which then connects to the central computer and controller 118 or 162. The central computer and controller 118 or 162 may connect to other equipment and interfaces as shown in FIG. 1A and 1B. The network connection 112 used to connect the sensor units to the central unit may be a digital communication network of either proprietary design or open systems design such as a Lonworks or BACNet protocol. The network connection 112 may also be part of a building control network or part of an Ethernet system used for the building's information system communication network. A twisted pair network, an optical fiber, a power line, or wireless technology may be used for implementation.

FIG. 1A and 1B shows an implementation of the air monitoring system 100 where one sensor unit 103 is connected to control unit 106 through a sensor interface card 122 without need for a distributed digital network. This approach may be used for a portable air monitoring unit 102 to monitor one sample location 108, or may be used in an installed system to monitor many sample locations 108 with the addition of extra installed equipment that brings air from multiple sample locations to the air monitoring unit 102 in sequential fashion. A star based system of tubes and centrally located solenoid valves may be used to sequentially pull air samples from remote sample locations to the air monitoring unit. Alternatively, a networked air sampling system, as described in U.S. Patent No. 6,125,710, may utilize a central backbone with branches to route multiple packets of air from multiple sample locations through the same backbone. Distributed switches, such as air solenoid valves, in the branches are controlled by a digital control network to bring air samples through the common backbone tube to the air monitoring unit, such that the packets of air may be monitored by the sensors 104 and the control unit 106 may store the air quality parameter data generated by the sensors.

Replace page 10, line 31-page 12, line 2 with the following paragraphs:

For both the portable and the installed implementations, the air monitoring system 100,

including the central unit 106 and the sensor unit 103, may be used in a portable fashion and may be moved from building to building to monitor different buildings or structures over time on either an as needed or on a periodic basis. For the installed system of Fig. 2, the central computer and controller 118 may be moved from building to building, and the distributed system components, such as the sensor units 110, may be installed permanently or semi-permanently. Typically in the system of Fig. 1A and 1B, the air monitoring unit 102, including the sensor unit 103 and the control unit 106, may be moved from building to building, and the tubing and controls may be installed permanently or semi-permanently. As a consequence, at least the control unit 106 of Fig. 1A and 1B, and the central computer and controller 118 of Fig. 2 may need to be reprogrammed and customized whenever the device is used to monitor a different building.

Referring to the air monitoring unit 102 of FIG. 1A and 1B, the air to be sampled is first brought into a manifold 124. The manifold is an air conduit inside the sensor unit 103. From manifold 124, the air is routed to one or more sensors 104. The air may be routed using switches 342, such as solenoid valves or pumps or other such devices. As shown in FIG. 1A and 1B, the manifold itself may contain sensors, such as on a manifold sensor card 126, to measure environmental or air quality parameters, such as temperature, humidity, barometric pressure or ozone level, which can change after the air enters the air monitoring unit . For example, as the air travels through the air monitoring unit the temperature may increase or ozone may react with the walls of the tubing in the unit, thereby reducing the accuracy of the measurement. These parameters are preferably measured soon after the air is brought into the air monitoring unit 102.

From the manifold, air may be routed to various sensors 104. As shown in Fig. 1A and 1B, the air is routed to into a radon detector 128, a particle detector 132 and a grab sampling unit 130. The radon detector 128 may be a continuously detecting instrument that may use one of various methods for detecting the presence of Radon gas. One possible method is to trap air particles that may be contaminated by the Radon gas in a piece of filter paper next to a radiation softened DRAM memory chip. Daughter decay elements from the Radon gas that are trapped in the filter paper emit alpha particles into the memory chip. This memory chip is filled with data and any changes in the state of the data indicate that an alpa particle has hit the memory chip. The number of counts of these alpha particles over time gives a reading of the amount of Radon

gas present in an area. Alternative approaches for measuring radon gas continuously, such as with Geiger detector type systems or other approaches, may also be used.

On page 15, replace lines 16-26 with the following paragraph:

In a preferred embodiment, the sensor bay 141 includes a sensor interface board 122 in Fig. 1A and 1B to support electrical connections for the sensor cards within the sensor bay. The sensor interface board may recognize any sensor card that is plugged into the sensor bay. The sensor card may include configuration information, such as sensor type and calibration. The configuration information may be stored in an EEPROM on the sensor card, such as Microchip Technology's 25C320 EEPROM. Use of a computer for the sensor bay may not be necessary when using the EEPROM. The sensor interface board may read the configuration information in order to recognize the sensor and properly interface with the sensor card related sensor data interface. The configuration information and the sensor data interface are accessed using a serial bus connection, such as an SPI, provided at the connection of the sensor cards to the sensor bay.

On page 16, replace lines 8-19 with the following paragraph:

Referring to FIG. 1A and 1B, the control unit 106 stores the air quality parameter data measured by the sensors. The control unit 106 may also convert analog sensor data to digital data for storage. As shown in FIG. 1A and 1B, a sensor interface card 122 may be used to convert the analog data to digital data for storage. The control unit 106 preferably includes a central computer and controller 162 that controls the functions of the air monitoring unit 102. Those functions may include, but are not limited to, controlling the flow of air through sensor unit 103 and acquisition of sensor data, storage of sensor data in some type of nonvolatile memory or storage media, processing sensor data to provide air quality information and communicating with a remotely located control center, such as a website 166. A local display 170 may be provided on the air monitoring unit 102. Preferably, the display 170 includes a touch screen, such that the user can input information into the control unit.

On page 17, replace line 12-page 18, line 2 with the following paragraphs:

The air monitoring unit 102 may be connected to a local network or to the Internet 178.

The connection of the air monitoring unit 102 to the Internet can be achieved in several ways using various communications control and media interface 168 interacting with various communication media 180. A local connection into the building's data network, assuming the building has such a network, may be used. A common network in use within commercial facilities is an Ethernet system running at 10 MHz or more. Assuming this network has a connection to the Internet, the network may be used for access to the Internet. Another method is a local wireless connection involving a 900 MHz spread spectrum or other transmission technique commonly used in cordless phones. This technique utilizes a base unit transceiver that connects to a local phone line and another transceiver in the air monitoring unit 106. When the air monitoring unit needs to send or receive data, the unit checks the phone line to determine if it is busy, and if not the unit makes a call and sends or receives data through a local Internet Service Provider (ISP). Another method is to use a cellular phone to directly access a local or remote ISP. Finally, the air monitoring unit may connect to a building control system, which is connected to the Internet to provide data to the building control system for use by this system and to connect to the Internet. It will be understood that any method of connection to the Internet may be used.

As shown in FIG. 1A and 1B, the website 166 may include remote web servers 182, a database 174, website programs and page generation software 172 and an expert system 186. The website 166 stores the air quality parameter data in the database 174 for recordkeeping and/or analysis. The data may be published on website 166 for access by the user via the account that the user sets up through the website and accesses through a computer and web browser 184.

On page 18, replace lines 3-23 with the following paragraph:

The Internet may be used to download information to the air monitoring unit 102 to initialize or modify its program, operation, and/or setup based on specific information obtained about the building, its occupants, its surrounding environment and known or suspected problems. This customization of the unit may be achieved by expert system 186 located remotely in website 166 or, alternatively, in the air monitoring unit. Preferably, customization of the air monitoring unit 102 is achieved through the Internet. This aspect of the invention may involve the user answering questions about the building on the website. In particular, the user may utilize

a user computer 184 to access website 166. The website may present to the user a series of questions, possibly determined by expert system 186, which permit the air monitoring unit 102 to be customized for a specific application. The questions may be a fixed set of questions, or questions later in the session may be modified depending on answers given earlier in the session. The information obtained from the user may be used to create a customized monitoring program to analyze a specific building. The program is downloaded from the website 166 through the Internet 178 via the communications media 180 and communications control and media interface 168 into the memory of the central computer and controller 162 to control its operation. As air quality parameter data is acquired in and around the building, the program, operation and/or setup of the monitoring unit may be modified based on the acquired data. Non-expert system approaches may be used to customize or personalize the unit based on building specific information. However, the expert system 186 provides customization based on an expert system's ability to handle information in a way that simulates a human expert.

On page 21, replace lines 24-26 with the following paragraph:

Referring to Fig. 7A and 7B, the expert system 186 is shown connected to the control unit 106 of the air monitoring unit 102. As shown, the expert system may be provided locally within the control unit.

Replace page 24, line 28-page 25, line 17 with the following paragraph:

One application of the air monitoring unit 102 involves rental or lease to the general public, and this embodiment is discussed in detail below. Specifically, the application of a portable air monitoring unit 102 as shown in FIG. 1A and 1B is discussed. Over time, a unit may be assigned to many different users. Alternatively, one user who owns or rents the air monitoring unit may use it in multiple buildings or locations, or a service organization may use the air monitoring unit to provide indoor air quality audits for many different users. To support these functions, the air monitoring unit 102 may be designed to have its user information erased after each use. At the onset of commissioning, the air monitoring unit may contain only generic configuration information, such as sensor calibration data. Configuration data, such as information in the user's account database, may be downloaded to the air monitoring unit 102

once the unit is in the user's possession. This configuration information is preferably downloaded to the air monitoring unit via the Internet. The air monitoring unit 102 takes on a "personality" that reflects the profile of the specific user's building and/or occupants. Any questions relevant to the evaluation of the indoor air quality for the building may be answered by the user on the website via the user's computer 184. The user's answers are located in the user's account, and are accessible by the website program 172 and expert system 186. Such questions may include questions about the building, the occupants and the building's surroundings. Many possible questions will be apparent to those of skill in the art. If the user is a homeowner, this configuration information may include customized room names assigned to a table of room numbers, as shown in Table 1 below.

On page 28, replace lines 14-24 with the following paragraph:

As shown in FIG. 8A and 8B, air monitoring unit 102 may include a continuous or periodically sampled air parameter sensor 220 and grab sampler 130. The taking of a sample by grab sampler 130 may be triggered by the air monitoring unit 102 itself, based on monitoring by the air parameter sensor 220. Alternatively, the air parameter sensor 220 may be monitored by the website 166 through the Internet. A command transmitted from the website 166 through the Internet 178 to the air monitoring unit 102 may trigger the capture of an air sample so that a more detailed analysis of the air quality parameter can be performed. In either case, the taking of the grab sample is triggered when the parameter sensed by sensor 220 meets a predetermined criteria. It will be understood that the criteria for triggering the taking of the grab sample can be based on measurements by two or more sensors and/or on other information.